



Amazon Web Services Data Engineering Immersion Day

Lab 1. Hydrating the Data Lake with DMS

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Introduction

This lab will give you an understanding of the AWS Database Migration Service (AWS DMS). You will migrate data from an existing Amazon Relational Database Service (Amazon RDS) Postgres database to an Amazon Simple Storage Service (Amazon S3) bucket that you create.



In this lab you will complete the following tasks:

1. Create a subnet group within the DMS Lab VPC
2. Create a DMS replication instance
3. Create a source endpoint
4. Create a target endpoint
5. Create a task to perform the initial migration of the data.

Optionally, you can add ongoing replication of data changes on the source

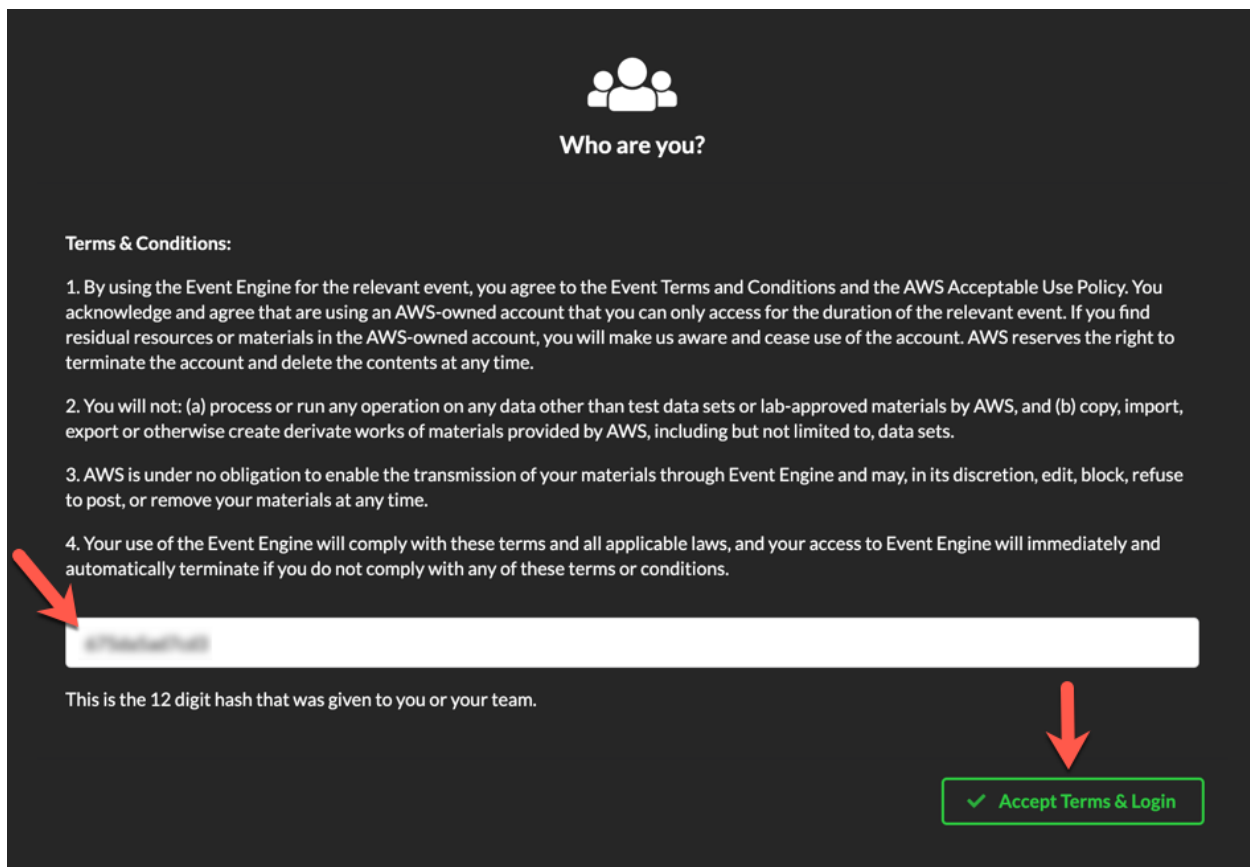
6. Create target endpoint for CDC files to place these files in a separate location than the initial load files
7. Create a task to perform the ongoing replication of data changes

Get Started Using the Lab Environment

Today, you are attending a formal event and you will have been sent your access details beforehand. If in the future you might want to perform these labs in your own AWS environment by yourself, you can follow instructions on GitHub - <https://github.com/aws-samples/data-engineering-for-aws-immersion-day>.

A 12-character access code (or 'hash') is the access code that grants you permission to use a dedicated AWS account for the purposes of this workshop.

1. Go to <https://dashboard.eventengine.run/>, enter the access code and click Proceed:



Who are you?

Terms & Conditions:

1. By using the Event Engine for the relevant event, you agree to the Event Terms and Conditions and the AWS Acceptable Use Policy. You acknowledge and agree that are using an AWS-owned account that you can only access for the duration of the relevant event. If you find residual resources or materials in the AWS-owned account, you will make us aware and cease use of the account. AWS reserves the right to terminate the account and delete the contents at any time.
2. You will not: (a) process or run any operation on any data other than test data sets or lab-approved materials by AWS, and (b) copy, import, export or otherwise create derivate works of materials provided by AWS, including but not limited to, data sets.
3. AWS is under no obligation to enable the transmission of your materials through Event Engine and may, in its discretion, edit, block, refuse to post, or remove your materials at any time.
4. Your use of the Event Engine will comply with these terms and all applicable laws, and your access to Event Engine will immediately and automatically terminate if you do not comply with any of these terms or conditions.

This is the 12 digit hash that was given to you or your team.

✓ Accept Terms & Login

2. On the Team Dashboard web page you will see a set of connection strings and parameters that you will need during the labs. Best to save them to a text file locally, alternatively you can always go to this page to review them. Replace the parameters with the corresponding values from here where indicated in subsequent labs:

Because you're at a formal event, some AWS resources have been pre-deployed for your convenience, for example

Lab 1. Hydrating the Data Lake with DMS

- RDS Postgres database that you will use as your source endpoint (parameter **DMSInstanceEndpoint**)
- VPC that you will deploy DMS to, etc

Modules

DMS_Student_Prereqs

Outputs:

Data Engineering Workshop

Parameter	Value
BucketName	mod-08b80667356c4f8a-dmslabs3bucket-1ijtekvr232zk
BusinessAnalystUser	mod-08b80667356c4f8a-BusinessAnalystUser-1DPVYKJ8G0JK3
BusinessAnalystUserPolicy	BusinessAnalystUserPolicy
DMSLabRoles3	arn:aws:iam::433083714985:role/mod-08b80667356c4f8a-DMSLabRoles3-10V87K4LU3P66
GlueLabRole	mod-08b80667356c4f8a-GlueLabRole-HB1L2G7U4DU8
S3BucketWorkgroupA	mod-08b80667356c4f8a-s3bucketworkgroupa-1sw7181wwqp6o
S3BucketWorkgroupB	mod-08b80667356c4f8a-s3bucketworkgroupb-10cz7ir988eoh
WorkgroupManagerUser	mod-08b80667356c4f8a-WorkgroupManagerUser-1DSHJDROQWRMZ
WorkgroupManagerUserPolicy	WorkgroupManagerUserPolicy

DMS_Instructor_Prereqs

Outputs:

Data Source for DMS Lab

Parameter	Value
DMSInstanceEndpoint	dmslabinstance.ckyqv1sdkm8m.us-east-1.rds.amazonaws.com
CDCFunction	arn:aws:lambda:us-east-1:433083714985:function:GenerateCDCData

3. On the Team Dashboard, please click AWS Console to log into the AWS Management Console:

Team Dashboard

Event

[AWS Console](#)[SSH Key](#)

Event: Macquarie Bank Data Engineering Immersion Day - Test

Team Name: Igor Izotov

Event ID: d2302d4ae9ff4ea2857846b74f7de7e2

Team ID: 1c2f7ad7ec044b0b8276f917c5983133

4. Click Open Console. For the purposes of this workshop, you will not need to use command line and API access credentials:

Dashboard

Logout

AWS Console Login

Remember to only use "us-east-1" as your region, unless otherwise directed by the event operator.

Login Link

Open AWS Console

Copy Login Link

Credentials / CLI Setup

Mac / Linux

Windows

Mac or Linux

```
export AWS_DEFAULT_REGION=us-east-1
export AWS_ACCESS_KEY_ID=AKIAIOSFODNN7EXAMPLE
export AWS_SECRET_ACCESS_KEY=wJalrXU3WhelZK3c6ZARi11Vcux8AR1ANfPqF3M9GLVutdYV4XsF9G
export AWS_SESSION_TOKEN=
```

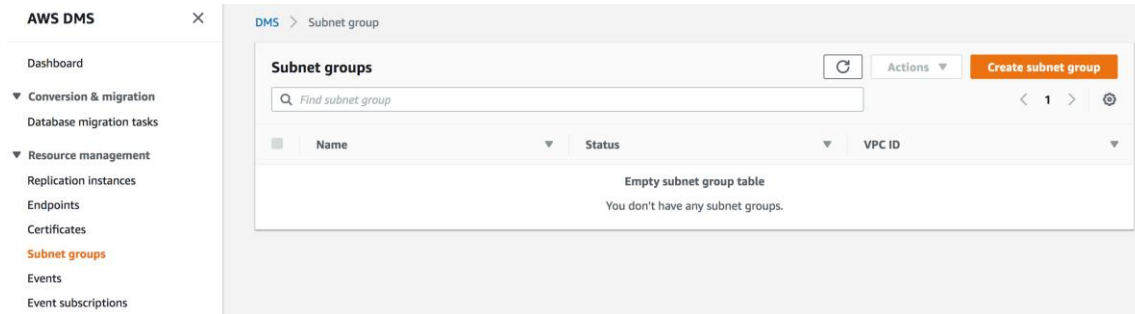
How do I use the AWS CLI?

Checkout the AWS CLI documentation here: <https://docs.aws.amazon.com/cli/latest/userguide/cli-chap-welcome.html>

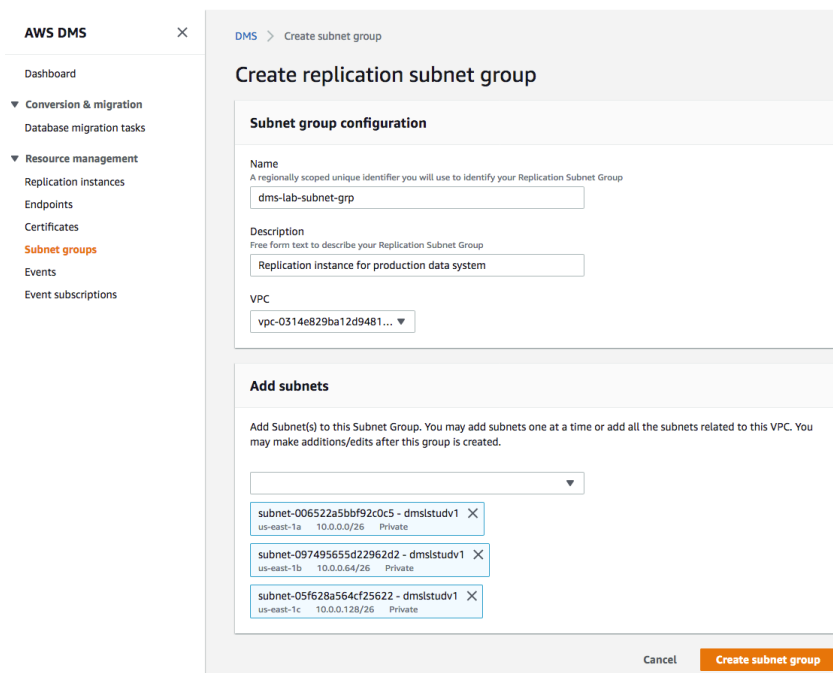
OK

Create the Subnet Group

1. Navigate to the DMS Console: <https://console.aws.amazon.com/dms/v2/home?region=us-east-1#firstRun>
2. On the DMS console, select **Subnet Groups**.

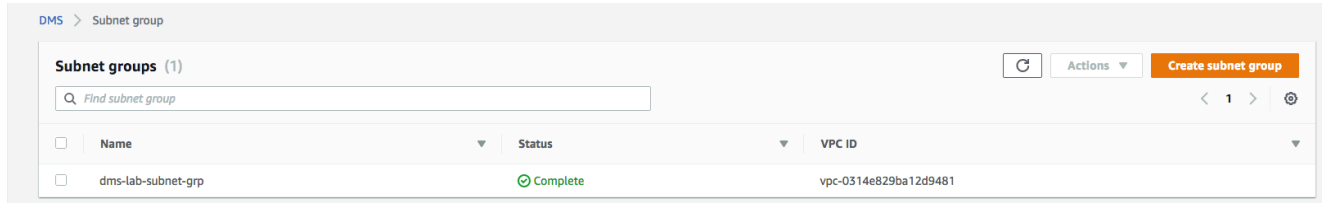


3. Click **Create subnet group**.
 - a. In the Identifier box, type a descriptive name that you will easily recognize (e.g., “dms-lab-subnet-grp”).
 - b. In the Description box, type an easily recognizable description (e.g., “**Replication instance for production data system**”).
 - c. For VPC, select the pre-created VPC ending with **dmslstudv1**.
The subnet list populates in the Available Subnets pane.
 - d. Select as many subnets as you want and click Add. The selected subnets move to the Subnet Group pane. Note: DMS requires at least two separate availability zones to be selected.



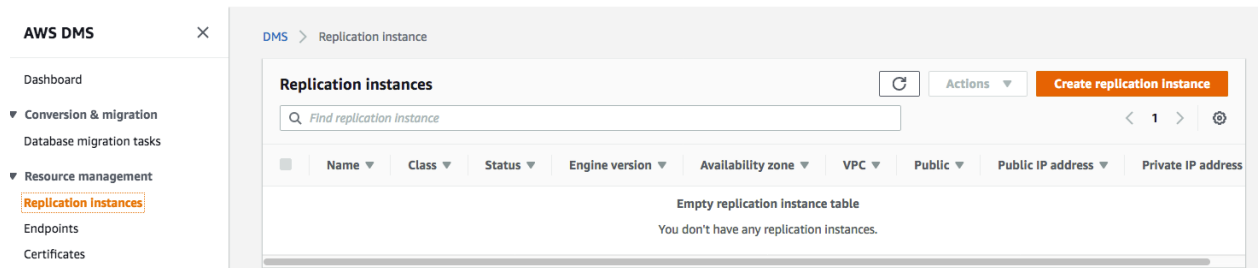
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4. Click Create subnet group
5. On the DMS console, the subnet group status displays Complete.



Create the Replication Instance

1. On the DMS console, select **Replication instances**.



2. Click **Create replication instance**.
 - a. For **Name**, type a name for the replication instance that you will easily recognize. (e.g., “DMS-Replication-Instance”).
 - b. For **Description**, type a description you will easily recognize. (e.g., “DMS Replication Instance”).
 - c. For **Instance class**, choose **dms.t2.medium**
 - d. Select **Engine version** as **3.3.1**
 - e. For VPC, select the name of the VPC that you created earlier with AWS CloudFormation template. VPC name ending with **dmslstudv1**

Lab 1. Hydrating the Data Lake with DMS

AWS DMS ×

Dashboard

▼ Conversion & migration

Database migration tasks

▼ Resource management

Replication instances

Endpoints

Certificates

Subnet groups

Events

Event subscriptions

What's new

Notifications

Replication instance configuration

Name
The name must be unique among all of your replication instances in the current AWS region.

Replication-Instance

Replication instance name must not start with a numeric value

Description

DMS-Replication-Instance

The description must only have unicode letters, digits, whitespace, or one of these symbols: _:/=+-@. 1000 maximum character.

Instance class
Choose an appropriate instance class for your replication needs. Each instance class provides differing levels of compute, network and memory capacity.

dms.t2.medium

Billing is based on [DMS pricing](#).

Engine version
Choose an AWS DMS version to run on your replication instance.

3.3.1

Allocated storage (GiB)
Choose the amount of storage space you want for your replication instance. AWS DMS uses this storage for log files and cached transactions while replication tasks are in progress.

50

VPC
Choose an Amazon Virtual Private Cloud (VPC) where your replication instance should run.

vpc-0537f7268d522baf3 - dmslstudv1

☐ **Multi AZ**
If you choose this option, AWS DMS will perform a multi-AZ deployment, with a primary instance in one availability zone (AZ) and a standby instance in another AZ. This configuration provides a highly available, fault-tolerant replication environment.

- f. Click **Advanced** to expand the section.
- g. Select the security group with **sgdefault** in the name.

AWS DMS ×

Dashboard

▼ Conversion & migration

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☒ **Publicly accessible**
If you choose this option, AWS DMS will assign a public IP address to your replication instance, and you'll be able to connect to databases outside of your Amazon VPC.

▼ Advanced security and network configuration

Replication subnet group
Choose a subnet group for your replication instance. The subnet group defines the IP ranges and subnets that your replication instance can use within the Amazon VPC you've chosen.

dms-lab-subnet-grp

Availability zone
Choose an availability zone (AZ) where you want your replication instance to run. The default is "No preference", meaning that AWS DMS will determine which AZ to use.

No Preference

VPC security group(s)
Choose one or more security groups for your replication instances. The security group(s) specify inbound and outbound rules to control network access to your replication instance.

Use default

dmslab-student-sgdefault-G2VY06TNTMNZ ×

KMS master key [Info](#)

(Default) aws/dms

Account

Description

Key ARN

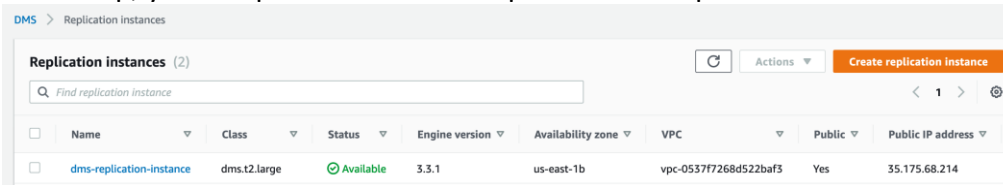
► **Maintenance**

Cancel **Create**

3. Click **Create**.

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- The DMS console displays **creating** for the instance status. When the replication instance is ready, the status changes to **available**. While replication instance is spinning up, you can proceed to next step for DMS endpoint creation.



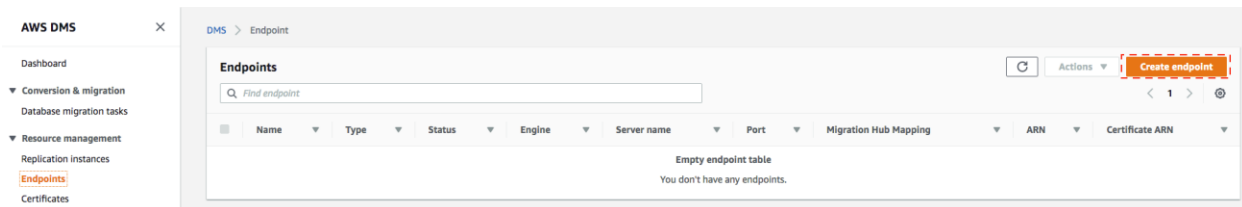
The screenshot shows the 'Replication instances' page in the AWS DMS console. It features a search bar, a table with columns for Name, Class, Status, Engine version, Availability zone, VPC, Public, and Public IP address, and a 'Create replication instance' button. The table contains one entry: 'dms-replication-instance' with class 'dms.t2.large', status 'Available', engine version '3.3.1', availability zone 'us-east-1b', VPC 'vpc-0537f7268d522ba3', public access 'Yes', and public IP address '35.175.68.214'.

Name	Class	Status	Engine version	Availability zone	VPC	Public	Public IP address
dms-replication-instance	dms.t2.large	Available	3.3.1	us-east-1b	vpc-0537f7268d522ba3	Yes	35.175.68.214

Create the DMS Source Endpoint

Please proceed to create your endpoints, without waiting for the step above.

- On the DMS console, select **Endpoints**



The screenshot shows the 'Endpoints' page in the AWS DMS console. It features a search bar, a table with columns for Name, Type, Status, Engine, Server name, Port, Migration Hub Mapping, ARN, and Certificate ARN, and a 'Create endpoint' button. The table is empty, with a message stating 'Empty endpoint table. You don't have any endpoints.'

Name	Type	Status	Engine	Server name	Port	Migration Hub Mapping	ARN	Certificate ARN
------	------	--------	--------	-------------	------	-----------------------	-----	-----------------

- Click **Create endpoint**.
 - select **Source endpoint** type.
 - For **Endpoint identifier**, select an easily recognizable name (e.g. **rds-source-endpoint**)
 - For Source engine, select **postgres**
 - For Server, enter the value of **DMSInstanceEndpoint** parameter value from your Team Dashboard
 - For Port, enter **5432**
 - For SSL mode, choose **none**
 - For User name, type **master**
 - For Password, type **master123**
 - For Database name, type **sportstickets**

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The screenshot shows the 'Create endpoint' page in the AWS DMS console. The left sidebar lists navigation options: Dashboard, Conversion & migration, Resource management, and Endpoints. The main content area is titled 'Create endpoint' and contains two sections: 'Endpoint type' and 'Endpoint configuration'.

Endpoint type

- ☒ **Source endpoint**
A source endpoint allows AWS DMS to read data from a database (on-premises or in the cloud), or from other data source such as Amazon S3.
- ☐ **Target endpoint**
A target endpoint allows AWS DMS to write data to a database, or to other data source.

☐ Select RDS DB instance

Endpoint configuration

Endpoint identifier Info
A label for the endpoint to help you identify it.
prodendpoint-postgre

Source engine
The type of database engine this endpoint is connected to.
postgres

Server name
dmslabinstance.c1ny3gywsvdz.us-east-1.rds.amazonaws.com

Port
The port the database runs on for this endpoint.
5432

Secure Socket Layer (SSL) mode
The type of Secure Socket Layer enforcement
none

User name Info
master

Password Info

Database name
sportstickets

3. Click **Create endpoint** to create the endpoint. When available, the endpoint status changes to **active**.
4. Check the **replication instance** created previously. Make sure the status is **available**.

The screenshot shows the 'Replication instances' page in the AWS DMS console. The left sidebar lists navigation options: Dashboard, Conversion & migration, Resource management, and Endpoints. The main content area is titled 'Replication instances (1)' and contains a table with one row.

	Name	Class	Status	Engine version	Availability zone	VPC
<input type="checkbox"/>	dms-replication-instance	dms.t2.medium	Available	3.3.1	us-east-1b	vpc-0f4679

5. Select your newly created source **endpoint**, and choose **Test connection** on the **Actions** drop-down list.

The screenshot shows the 'Endpoints' page in the AWS DMS console. The left sidebar lists navigation options: Dashboard, Conversion & migration, Resource management, and Endpoints. The main content area is titled 'Endpoints (1)' and contains a table with one row.

	Name	Type	Status	Engine	Server name	Port
<input checked="" type="checkbox"/>	srcdb	Source	Active	PostgreSQL	dmslabinstance.ctmbri3fwuo4.us-east-1.rds.amazonaws.com	5432

The 'Actions' dropdown menu is open, showing options: Modify, Test connection, and Delete.

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- Click **Run test**. This step tests connectivity to the source database system. If successful, the message “Connection tested successfully” appears. **You may need to wait for the DMS replication instance to become available first.**

DMS > Endpoints > rds-source-endpoint > Test endpoint connection

Test your endpoint connection by selecting a replication instance within your desired VPC. After clicking “Run test”, an endpoint will be created with the details provided and attempt to connect to the instance. If the connection fails, you can edit and test it again. Endpoints that aren't saved will be deleted.

Replication instance
A replication instance performs the database migration

dms-replication-instance

Run test

Endpoint identifier	Replication instance	Status	Message
rds-source-endpoint	dms-replication-instance	successful	

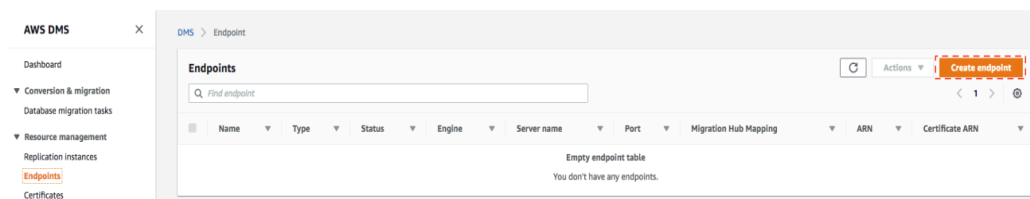
Back

Create the Target Endpoint

Before start, make sure you have the following values handy (can be found on your team dashboard):

- DMSLabRoleS3** ARN – It looks like “arn:aws:iam::<Account number>:role/xxx-DMSLabRoleS3-xxxx”
- BucketName** - It looks like “xxx-dmslabs3bucket-xxxx”

- On the DMS console, select **Endpoints**.



- Click **Create endpoint**.
 - For Endpoint type, select **Target endpoint**.
 - For Endpoint identifier, type an easily recognized name such as **s3-target-endpoint**.
 - For Target engine, choose **s3**.
 - For Service access role ARN, paste the **DMSLabRoleS3** value noted earlier
 - For Bucket name, paste the value of **BucketName** noted earlier
 - For Bucket folder, type **tickets**

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The screenshot shows the AWS DMS console 'Create endpoint' page. On the left is a navigation menu with 'AWS DMS' at the top, followed by 'Dashboard', 'Conversion & migration', 'Database migration tasks', 'Resource management', 'Replication instances', 'Endpoints' (highlighted in orange), 'Certificates', 'Subnet groups', 'Events', and 'Event subscriptions'. The main panel is titled 'DMS > Create endpoint' and 'Create endpoint'. It has two main sections: 'Endpoint type' and 'Endpoint configuration'. In 'Endpoint type', 'Source endpoint' is unselected and 'Target endpoint' is selected. Below this is a checkbox for 'Select RDS DB instance'. The 'Endpoint configuration' section contains several fields: 'Endpoint identifier' (value: targetendpoint), 'Target engine' (value: s3), 'Service access role ARN' (value: arn:aws:iam::341259728059:role/dmslab-student-DMSLabRoleS3-8DVW2RR7J7QZ), 'Bucket name' (value: dmslab-student-dmslab-s3bucket-wot4b73cw3), and 'Bucket folder' (value: tickets).

- g. Click **Endpoint-specific settings** to expand the section.
- h. In the **Extra connection attributes** box, type **addColumnNames=true**. This attribute includes the column names in the files in the S3 bucket.
- i. Expand the **Test endpoint connection (optional) section**, and choose your VPC name with **dmslstudv1** on the VPC drop-down list.
- j. Click **Run test**. This step tests connectivity to the source database system. If successful, the message “Connection tested successfully” appears.

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AWS DMS

Dashboard

▼ Conversion & migration

Database migration tasks

▼ Resource management

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Event subscriptions

▼ **Endpoint-specific settings**

Extra connection attributes
Type any additional connection parameters here. See the documentation for more information.

addColumnName=true

▼ **Test endpoint connection (optional)**

Test your endpoint connection by selecting a replication instance within your desired VPC. After clicking "Run test", an endpoint will be created with the details provided and attempt to connect to the instance. If the connection fails, you can edit and test it again. Endpoints that aren't saved will be deleted.

VPC
vpc-0314e829ba12d9481 - dmslstudv1

Replication instance
A replication instance performs the database migration
dms-replication-instance

Run test

After clicking "Run test", an endpoint will be created with the details provided and attempt to connect to the instance. If the connection fails, you can edit and test it again. Endpoints that aren't saved will be deleted.

Endpoint identifier	Replication instance	Status	Message
targetendpoint	dms-replication-instance	successful	

Cancel **Create endpoint**

3. Click **Create Endpoint**. When available, the endpoint status changes to **active**.

AWS DMS

Dashboard

▼ Conversion & migration

Database migration tasks

▼ Resource management

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Endpoints

Certificates

DMS > Endpoint

Endpoints (2)

Find endpoint

	Name	Type	Status	Engine	Server name	Port	Migration Hub Mapping	ARN
<input type="checkbox"/>	prodendpoint-postgre	Source	Active	PostgreSQL	dmslabinstance.c1ny3gywsvdz.us-east-1.rds.amazonaws.com	5432		arn:aws:dmsus-east-1:341259728059:endp...
<input type="checkbox"/>	targetendpoint	Target	Active	Amazon S3	-	-		arn:aws:dmsus-east-1:341259728059:endp...

Create a task to perform the initial full copy

1. On the DMS console, select **Database Migration Tasks**.

AWS DMS

Dashboard

▼ Conversion & migration

Database migration tasks

▼ Resource management

Replication instances

Endpoints

Certificates

DMS > Database migration tasks

Database migration tasks

Find task

	Name	Status	Source	Target	Type	Progress	Elapsed time	Tables loaded	Tables loading	Tables queued	Tables errored
Empty replication task table You don't have any replication tasks.											

2. Click **Create Task**.

a. Type an easily recognized **Task name** e.g. **dms-full-dump-task**

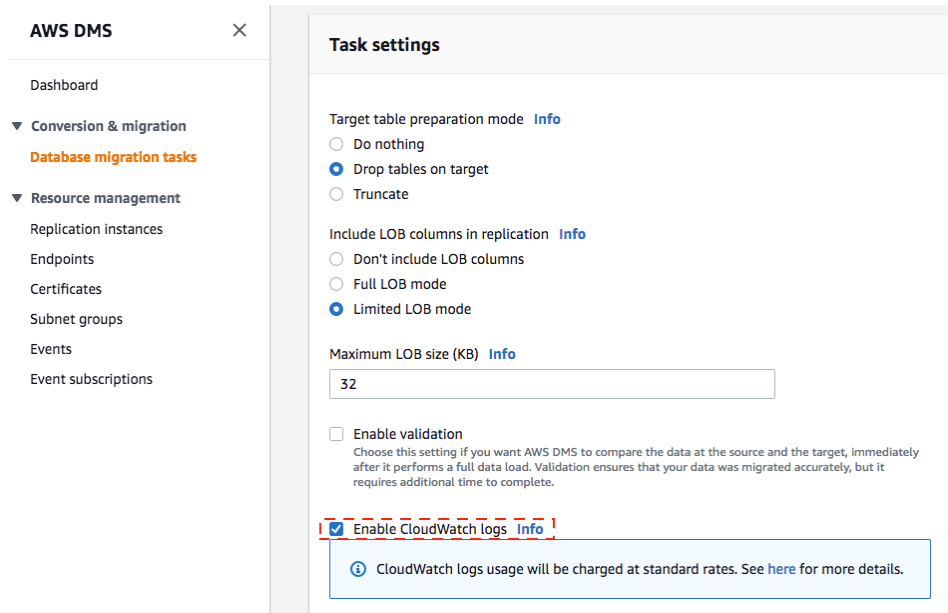
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- b. Select your **Replication instance** from drop down.
- c. Select your **Source endpoint** from drop down.
- d. Select your **Target endpoint** from drop down.
- e. For, **Migration type** choose **Migrate existing data**.
- f. Select **Start task on create**

The screenshot shows the AWS DMS console interface. On the left is a navigation sidebar with the following items: Dashboard, Conversion & migration (expanded), Database migration tasks (selected), Resource management (expanded), Replication instances, Endpoints, Certificates, Subnet groups, Events, and Event subscriptions. Below these are 'What's new' and 'Notifications'. The main content area is titled 'Create database migration task' and contains a 'Task configuration' section with the following fields: 'Task identifier' (text input with 'dms-full-dump-task'), 'Replication instance' (dropdown menu with 'dms-replication-instance - vpc-0537f7268d522baf3'), 'Source database endpoint' (dropdown menu with 'rds-source-endpoint'), 'Target database endpoint' (dropdown menu with 's3-target-endpoint'), 'Migration type' (dropdown menu with 'Migrate existing data' and an 'Info' link), and a checked checkbox for 'Start task on create'.

- g. Under **Task Settings**, select the **Enable CloudWatch logs** check box.

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AWS DMS

Dashboard

▼ Conversion & migration

Database migration tasks

▼ Resource management

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Task settings

Target table preparation mode [Info](#)

☐ Do nothing

☒ Drop tables on target

☐ Truncate

Include LOB columns in replication [Info](#)

☐ Don't include LOB columns

☐ Full LOB mode

☒ Limited LOB mode

Maximum LOB size (KB) [Info](#)

32

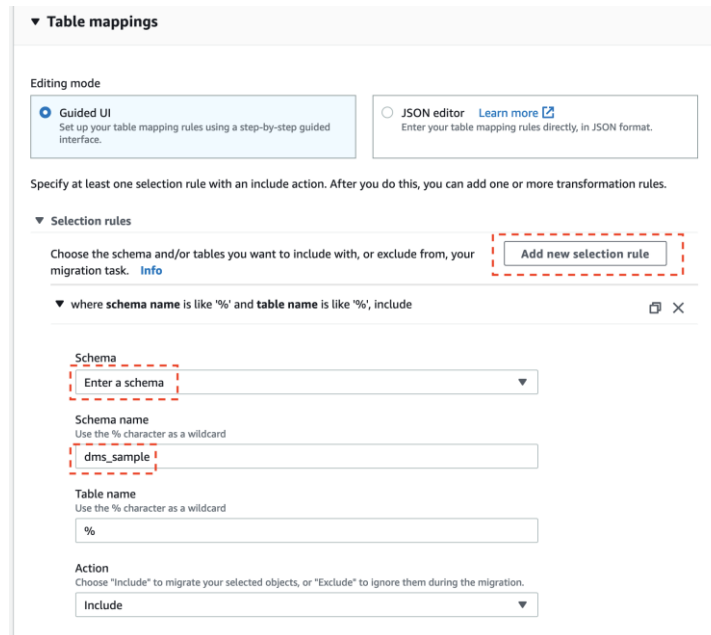
☐ Enable validation

Choose this setting if you want AWS DMS to compare the data at the source and the target, immediately after it performs a full data load. Validation ensures that your data was migrated accurately, but it requires additional time to complete.

☒ Enable CloudWatch logs [Info](#)

CloudWatch logs usage will be charged at standard rates. See [here](#) for more details.

- h. Go to **Table Mappings**.
- i. Click on **Add new selection rule** and select **Enter a Schema** in **Schema** field.
- j. For Schema name, type **dms_sample** and keep the settings for the remaining fields



▼ Table mappings

Editing mode

☒ Guided UI

Set up your table mapping rules using a step-by-step guided interface.

☐ JSON editor [Learn more](#)

Enter your table mapping rules directly, in JSON format.

Specify at least one selection rule with an include action. After you do this, you can add one or more transformation rules.

▼ Selection rules

Choose the schema and/or tables you want to include with, or exclude from, your migration task. [Info](#)

[Add new selection rule](#)

▼ where schema name is like '%' and table name is like '%', include

Schema

Enter a schema

Schema name

Use the % character as a wildcard

dms_sample

Table name

Use the % character as a wildcard

%

Action

Choose "Include" to migrate your selected objects, or "Exclude" to ignore them during the migration.

Include

- 3. Click **Create task**. Your task is created and starts automatically. (Note: The complete creation and data extraction process takes around 5 minutes.)
- 4. Once complete, the console displays 100% complete.

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DMS > Database migration tasks

Database migration tasks (1)

Find task

< 1 >

<input type="checkbox"/>	Name ▾	Status ▾	Source ▾	Target ▾	Type ▾	Progress ▾	Elapsed time ▾	Tables loaded ▾	Tables loading ▾	Tables queue ▾
<input type="checkbox"/>	dms-task	Load complete	src-rds	targets3	Full load	100%	5 m	16	0	

5. Select your task and explore the summary. Under **Table** statistics tab you can review all table information loaded in S3 from RDS by DMS

DMS > Database migration tasks > dms-task

dms-task

Summary

Status: Load complete

Type: Full load

Source: prodendpoint-postgre

Target: targetendpoint

Overview details

Basic configuration

Task ARN: arn:aws:dms:us-east-1:341259728059:task:MUYIRCLBYT45EZESVNFNGAUL4

Type: Full load

Source: prodendpoint-postgre

Last failure message: *

Started: 5/29/2019, 10:55:51 AM GMT-0700

Status: Load complete

Replication instance: dms-replication-instance

Target: targetendpoint

Created: 5/29/2019, 10:55:15 AM GMT-0700

Migration task logs: info

View logs

Task settings (JSON)

Table statistics (16)

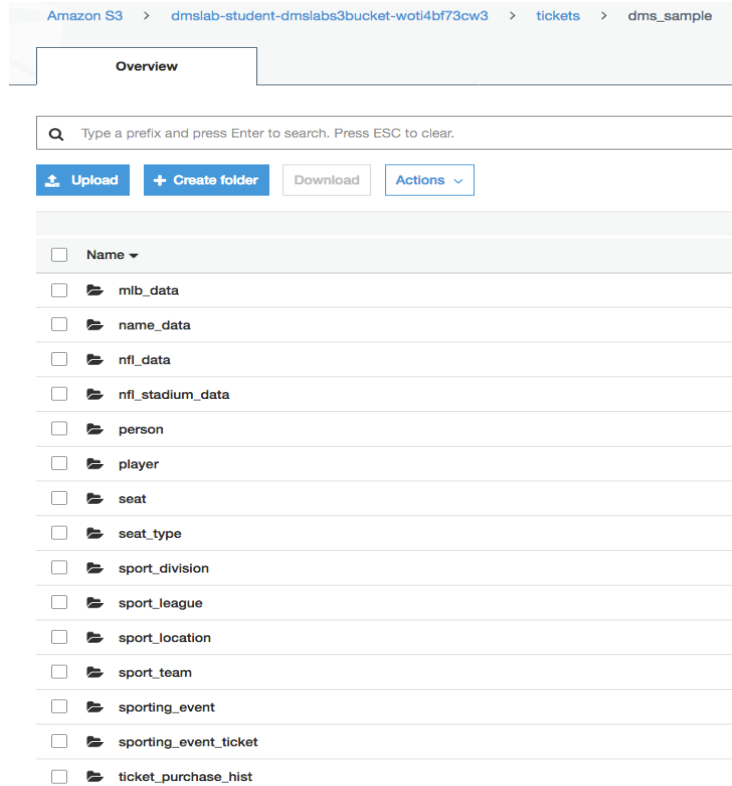
Find schema

< 1 >

<input type="checkbox"/>	Schema name ▾	Table ▾	Load state ▾	Inserts ▾	Deletes ▾	Updates ▾	DDLs ▾	Full load rows ▾	Total ▾	Validation state ▾	Validation pending ▾
<input type="checkbox"/>	dms_sample	seat_type	Table completed	0	0	0	0	6	6	Not enabled	0
<input type="checkbox"/>	dms_sample	seat	Table completed	0	0	0	0	603,631	603,631	Not enabled	0
<input type="checkbox"/>	dms_sample	mlb_data	Table completed	0	0	0	0	2,230	2,230	Not enabled	0
<input type="checkbox"/>	dms_sample	player	Table completed	0	0	0	0	5,157	5,157	Not enabled	0
<input type="checkbox"/>	dms_sample	ticket_purchase_hist	Table completed	0	0	0	0	6,038,756	6,038,756	Not enabled	0
<input type="checkbox"/>	dms_sample	person	Table completed	0	0	0	0	7,025,584	7,025,584	Not enabled	0
<input type="checkbox"/>	dms_sample	name_data	Table completed	0	0	0	0	5,360	5,360	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_team	Table completed	0	0	0	0	62	62	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_league	Table completed	0	0	0	0	2	2	Not enabled	0
<input type="checkbox"/>	dms_sample	sporting_event	Table completed	0	0	0	0	1,158	1,158	Not enabled	0
<input type="checkbox"/>	dms_sample	sporting_event_ticket	Table completed	0	0	0	0	15,212,460	15,212,460	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_division	Table completed	0	0	0	0	14	14	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_location	Table completed	0	0	0	0	62	62	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_type	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	nfl_stadium_data	Table completed	0	0	0	0	32	32	Not enabled	0
<input type="checkbox"/>	dms_sample	nfl_data	Table completed	0	0	0	0	2,928	2,928	Not enabled	0

6. Open the S3 console to view the data that was copied by DMS:
<https://s3.console.aws.amazon.com/s3/home?region=us-east-1#>
7. Click on the bucket used as the DMS target and navigate to **/tickets/dms_sample/** to view the loaded tables, one folder per table

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8. Download one of the files:

- Navigate further to **mlb_data/LOAD00000001.csv**, select the check box next to the file name and click **Download** in the pop-up window.
- Click **Save File**.
- Open the file.

You will notice that the file contains the column headers in the first row as requested by the “addColumnNames=true” connection attribute we included when we created the s3 target endpoint. Note that column names are included in the file in the first row.

	A	B	C	D	E
1	id	sport_team_id	last_name	first_name	full_name
2	1	131	Adam Loewen	Adam	Loewen
3	11	131	A.J. Pollock	A.J.	Pollock
4	21	131	Alex Sanabia	Alex	Sanabia
5	31	131	Andrew Chafin	Andrew	Chafin
6	41	131	Andy Marte	Andy	Marte
7	51	131	Archie Bradley	Archie	Bradley
8	61	131	Ben Francisco	Ben	Francisco
9	71	131	Braden Shipley	Braden	Shipley
10	81	131	Bradin Hagens	Bradin	Hagens
11	91	131	Brandon Drury	Brandon	Drury
12	101	131	Brett Jackson	Brett	Jackson

You may notice that the primary key column was loaded in scientific notation:

LOAD00000001.csv - Notepad

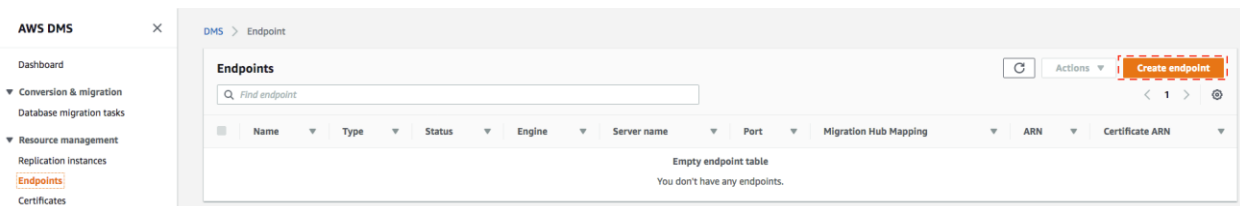
File Edit Format View Help

```
mlb_id,mlb_name,mlb_pos,mlb_team,mlb_team_long,bats,throws,birth_year,bp
+5.065600000000000e+05,Alexi Amarista,3B,SD,San Diego Padres,L,R,1989,+
+4.582100000000000e+05,Alexi Casilla,2B,TB,Tampa Bay Rays,S,R,1984,+4.5
+4.683960000000000e+05,Alexi Ogando,P,ATL,Atlanta Braves,R,R,1983,+4.9
+4.696860000000000e+05,Alfredo Aceves,P,NYY,New York Yankees,R,R,1982,+
+4.516280000000000e+05,Alfredo Figaro,P,TEX,Texas Rangers,R,R,1984,+5.2
+5.540540000000000e+05,Alfredo Gonzalez,C,CWS,Chicago White Sox,R,R,19
+5.012450000000000e+05,Alfredo Marte,LF,BAL,Baltimore Orioles,R,R,1989,
+4.305800000000000e+05,Alfredo Simon,P,CIN,Cincinnati Reds,R,R,1981,+4.
+4.553780000000000e+05,Ali Solis,C,LAD,Los Angeles Dodgers,R,R,1987,+5.
+4.888520000000000e+05,Allan Dykstra,1B,TB,Tampa Bay Rays,L,R,1987,+5.7
+5.018000000000000e+05,Allen Craig,1B,BOS,Boston Red Sox,R,R,1984,+5.16
```

This is due to the tables at the source having primary key as **double precision**. Keep in mind that DMS allows you to perform additional transformations, for example type casting at load time. Here we will proceed without making any further modifications.

(Optional) Create a DMS endpoint to perform ongoing replication

1. Navigate to the DMS console: <https://console.aws.amazon.com/dms/v2/home?region=us-east-1#dashboard> and select **Endpoints**:



2. Click **Create endpoint**.
 - a. For **Endpoint type**, select **Target**
 - b. For **Endpoint identifier**, type **rds-cdc-endpoint**
 - c. For **Target engine**, choose **s3**.
 - d. For Service access role ARN, paste the **DMSLabRoleS3** number noted earlier
 - e. For Bucket name, paste the **S3 Bucket Name** noted earlier
 - f. For **Bucket folder**, type **cdc**.

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Create endpoint

Endpoint type [Info](#)

☐ **Source endpoint**
A source endpoint allows AWS DMS to read data from a database (on-premises or in the cloud), or from other data source such as Amazon S3.

☒ **Target endpoint**
A target endpoint allows AWS DMS to write data to a database, or to other data source.

☐ Select RDS DB instance

Endpoint configuration

Endpoint identifier [Info](#)
A label for the endpoint to help you identify it.

Target engine
The type of database engine this endpoint is connected to.

Service access role ARN
Role that can access target

Bucket name
The name of an Amazon S3 bucket where DMS will read the files from

Bucket folder
The Amazon S3 bucket path where the CSV files can be found

- Click **Endpoint-specific settings** to expand the section.
- In the **Extra connection attributes** box, type **addColumnName=true** to include column names in the files in the S3 bucket.
- Expand the **Test endpoint connection (optional)** section, and choose your **dmslstudv1** name on the VPC drop-down list.
- Click Run test. This step tests connectivity to the source database system. If successful, the message “Connection tested successfully” appears.

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▼ Endpoint-specific settings

Extra connection attributes
Type any additional connection parameters here. See the documentation for more information.

addColumnname=true

▼ Test endpoint connection (optional)

Test your endpoint connection by selecting a replication instance within your desired VPC.
After clicking "Run test", an endpoint will be created with the details provided and attempt to connect to the instance. If the connection fails, you can edit and test it again. Endpoints that aren't saved will be deleted.

VPC
vpc-0314e829ba12d9481 - dmslstudv1

Replication instance
A replication instance performs the database migration
dms-replication-instance

Run test

After clicking "Run test", an endpoint will be created with the details provided and attempt to connect to the instance. If the connection fails, you can edit and test it again. Endpoints that aren't saved will be deleted.

Endpoint Identifier	Replication instance	Status	Message
cdcendpoint	dms-replication-instance	successful	

Cancel **Create endpoint**

3. Click **Create endpoint**.

4. When available, the endpoint status changes to active.

DMS > Endpoint

Endpoints (3) Find endpoint Actions **Create endpoint**

	Name	Type	Status	Engine	Server name	Port	Migration Hub Mapping	ARN
<input checked="" type="checkbox"/>	cdcendpoint	Target	Active	Amazon S3	-	-		arn:aws:dms:us-east-1:341259728059:endp
<input type="checkbox"/>	prodendpoint-postgre	Source	Active	PostgreSQL	dmslabinstance.c1ny3gywsvdz.us-east-1.rds.amazonaws.com	5432		arn:aws:dms:us-east-1:341259728059:endp
<input type="checkbox"/>	targetendpoint	Target	Active	Amazon S3	-	-		arn:aws:dms:us-east-1:341259728059:endp

(Optional) Create a task to perform ongoing replication

1. Navigate to the DMS console: <https://console.aws.amazon.com/dms/v2/home?region=us-east-1#dashboard> and select **Database Migration Tasks**.

AWS DMS

Database migration tasks Find task Actions **Create task**

	Name	Status	Source	Target	Type	Progress	Elapsed time	Tables loaded	Tables loading	Tables queued	Tables errored
Empty replication task table You don't have any replication tasks.											

2. Click **Create Task**.

- a. Type **cdctask** as **Task Identifier**
- b. Select your **Replication instance**.
- c. Select your **Source endpoint**.
- d. Select **Target endpoint** as **rds-cdc-endpoint** created in the previous section.
- e. For **Migration type**, choose **Replicate data changes only**.

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- f. Select the Start task on create check box.

The screenshot shows the 'Create database migration task' page in the AWS DMS console. The breadcrumb navigation is 'DMS > Database migration tasks > Create database migration task'. The main heading is 'Create database migration task'. Below it is the 'Task configuration' section with the following fields:

- Task identifier:
- Replication instance:
- Source database endpoint:
- Target database endpoint:
- Migration type: (with an 'Info' link)

At the bottom, there is a checkbox labeled 'Start task on create' which is checked.

- g. In **Task Settings**, Select the **Enable CloudWatch logs** check box. Do not enable the validation.

The screenshot shows the 'Task settings' page in the AWS DMS console. The left sidebar shows the 'AWS DMS' navigation menu with 'Database migration tasks' selected. The main content area is titled 'Task settings' and contains the following settings:

- Target table preparation mode: ☒ Drop tables on target (with 'Info' link)
- Include LOB columns in replication: ☒ Limited LOB mode (with 'Info' link)
- Maximum LOB size (KB): (with 'Info' link)
- Enable validation: ☐ (with a description: 'Choose this setting if you want AWS DMS to compare the data at the source and the target, immediately after it performs a full data load. Validation ensures that your data was migrated accurately, but it requires additional time to complete.'))
- Enable CloudWatch logs: ☒ (with an 'Info' link)

A blue information box at the bottom states: 'CloudWatch logs usage will be charged at standard rates. See here for more details.'

- h. Go to **Table Mappings**.
- i. Click on **Add new selection rule** and select **Enter a Schema** in Schema field.
- j. For **Schema name**, type **dms_sample** and keep the values in the remaining fields

Lab 1. Hydrating the Data Lake with DMS

▼ Table mappings

Editing mode

☒ Guided UI
Set up your table mapping rules using a step-by-step guided interface.

☐ JSON editor [Learn more](#)
Enter your table mapping rules directly, in JSON format.

Specify at least one selection rule with an include action. After you do this, you can add one or more transformation rules.

▼ Selection rules

Choose the schema and/or tables you want to include with, or exclude from, your migration task. [Info](#)

[Add new selection rule](#)

▼ where schema name is like '%' and table name is like '%', include

Schema

Enter a schema

Schema name

Use the % character as a wildcard

dms_sample

Table name

Use the % character as a wildcard

%

Action

Choose "Include" to migrate your selected objects, or "Exclude" to ignore them during the migration.

Include

- Click Create task. Your task is created and starts automatically. You can see status as **ongoing replication**, after couple of minutes.

DMS > Database migration tasks

Database migration tasks (2)

Find task

Actions Create task

	Name	Status	Source	Target	Type	Progress	Elapsed time	Tables loaded	Tables loading	Tables queued
<input type="checkbox"/>	dms-task	Load complete	prodendpoint-postgre	targetendpoint	Full load	100 %	9 m	16	0	0
<input checked="" type="checkbox"/>	newcdc	Replication ongoing	prodendpoint-postgre	cdcendpoint	Ongoing replication	100 %	0 m	16	0	0

Once complete, the console displays 100% complete.

- To generate CDC activity which above migration task will capture, we provisioned a Lambda function **GenerateCDCData** that will generate some new data in the source database. Start a new browser tab and navigate to [this link](#).

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The screenshot shows the AWS Lambda console for the `GenerateCDCData` function. The breadcrumb navigation is `Lambda > Functions > GenerateCDCData`. The ARN is `arn:aws:lambda:us-east-1:433083714985:function:GenerateCDCData`. The function is associated with an application, as indicated by the message: "This function belongs to an application. Click here to manage it." The `Configuration` tab is selected, showing the `Designer` view. The function is currently configured with no triggers or destinations. The `Function code` tab is also visible. The bottom of the console shows the standard AWS menu with `File`, `Edit`, `Find`, `View`, `Go`, `Tools`, `Window`, `Save`, and `Test`.

We will be invoking the Lambda function via a test event. Click **Test** and in the popup window, enter **test** under **event name** and click **Create** to create a test event:

The `Configure test event` dialog box is shown. It has a close button in the top right corner. The text explains: "A function can have up to 10 test events. The events are persisted so you can switch to another computer or web browser and test your function with the same events." There are two radio buttons: `Create new test event` (selected) and `Edit saved test events`. Under `Event template`, the dropdown menu is set to `hello-world`. Under `Event name`, the text input field contains `test`. At the bottom, there is a code editor showing a JSON event template:

```
1 {  
2   "key1": "value1",  
3   "key2": "value2",  
4   "key3": "value3"  
5 }
```


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Now with a test event created, click **Test** again (feel free to click it a few times) to generate some changes in the source database:

[Lambda](#) > [Functions](#) > GenerateCDCData ARN - arn:aws:lambda:us-east-1:433083714985:function:GenerateCDCData

GenerateCDCData Throttle Qualifiers ▼ Actions ▼ test ▼ **Test** Save

This function belongs to an application. [Click here](#) to manage it. ×

You may need to wait 5 to 10 minutes for CDC data to first reflect in your RDS postgres database and then picked up by DMS CDC migration task.

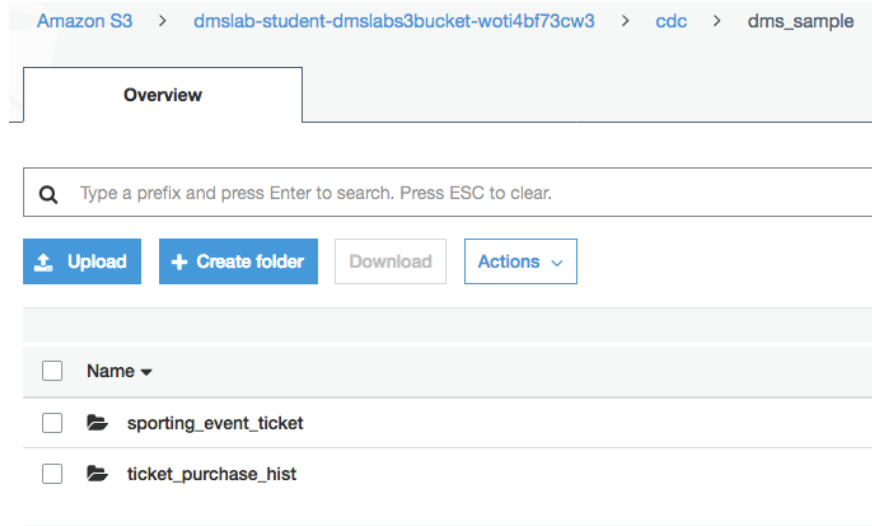
- Once the CDC Data gets replicated, you can navigate to CDC task details, and under **Table statistics** tab review the details, as shown below:

Note: In case you see DMS CDC task in fail/error status. Make sure your replication instance version is 3.3.1 and it is large enough (dms.t2.medium or above) to run CDC replication task

Table statistics (16)											
<input type="text" value="Find schema"/>											
Validate again Reload table data											
< 1 >											
<input type="checkbox"/>	Schema name ▼	Table ▼	Load state ▼	Inserts ▼	Deletes ▼	Updates ▼	DDLs ▼	Full load rows ▼	Total ▼	Validation state ▼	Validation pending ▼
<input type="checkbox"/>	dms_sample	seat_type	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	seat	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	mlb_data	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	player	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	ticket_purchase_hist	Table completed	11,002	0	0	0	0	11,002	Not enabled	0
<input type="checkbox"/>	dms_sample	person	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	name_data	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_team	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_league	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	sporting_event	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	sporting_event_ticket	Table completed	0	0	11,002	0	0	11,002	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_division	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_location	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	sport_type	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	nfl_stadium_data	Table completed	0	0	0	0	0	0	Not enabled	0
<input type="checkbox"/>	dms_sample	nfl_data	Table completed	0	0	0	0	0	0	Not enabled	0

- Open the S3 console to view the data that was copied by DMS:
<https://s3.console.aws.amazon.com/s3/home?region=us-east-1#>
- Click on the bucket used as the DMS target and navigate to **/cdc/dms_sample/** to view the loaded tables, one folder per table

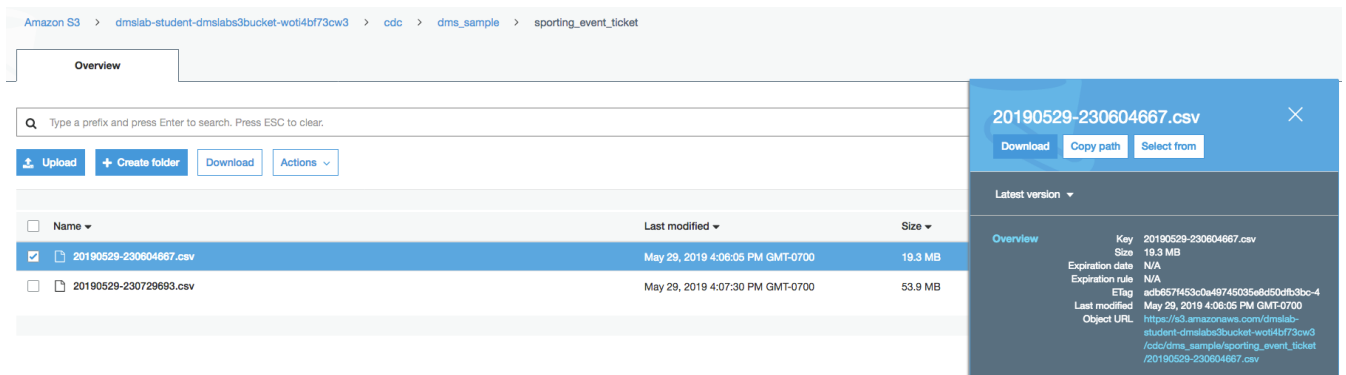
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8. Download one of the files:

- Select the check box next to the object name and click Download in the pop-up window.
- Click **Save File**.
- Open the file.

You will notice that the file contains the column headers in the first row as requested by the **addColumnName=true** connection attribute we included when we created the s3 target endpoint.



Note that file name has a timestamp. You can see the header is included and the operation column is added at the beginning of each row. The file below shows updates (U) to the table along with the values after the update. Inserts (I) show data after the insert and Deletes (D) show data before the delete.

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	A	B	C	D	E	F	G	H	I	J
	Op	id	sporting_event_id	sport_location_id	seat_level	seat_section	seat_row	seat	ticketholder_id	ticket_price
U		145192591	3931	4	2	10 A		2	2898028	98
U		145192601	3931	4	2	10 A		1	2898028	98
U		145192581	3931	4	2	10 A		3	2898028	98
U		145192501	3931	4	2	10 B		1	2898028	98
U		145187751	3931	4	2	13 B		2	2898028	49
U		145187741	3931	4	2	13 B		3	2898028	49
U		145187721	3931	4	2	13 C		2	2898028	49
U		145187711	3931	4	2	13 C		3	2898028	49
U		145187731	3931	4	2	13 C		1	2898028	49
U		145187701	3931	4	2	14 A		1	2898028	49
U		145187681	3931	4	2	14 A		3	2898028	49
U		145187691	3931	4	2	14 A		2	2898028	49
U		145187471	3931	4	2	14 B		3	2898028	49
U		145187671	3931	4	2	14 B		1	2898028	49
U		145187481	3931	4	2	14 B		2	2898028	49
U		145187451	3931	4	2	14 C		2	2898028	49
U		145187461	3931	4	2	14 C		1	2898028	49
U		145190341	3931	4	2	14 C		3	2898028	49
U		145183201	3931	4	2	15 A		4	2898028	49
U		145179691	3931	4	2	15 A		1	2898028	49
U		145179661	3931	4	2	15 A		4	2898028	49
U		145179671	3931	4	2	15 A		3	2898028	49
U		145179681	3931	4	2	15 A		2	2898028	49
U		145190321	3931	4	2	15 A		2	2898028	49